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ABSTRACT

A description of various activities of the Programmed Learning Committee of the Concordia University Libraries precedes sections on computer assisted instruction (CAI) applications for computer facilities in the library, other computer applications, and space and environment implications of these applications. The first section addresses such topics as CAI applications; CAI courseware; networks, focusing on the Health Education Network and its available systems such as the SDC PLATO and EDUNET; CAI at Concordia; planning for the future; the role of the library; and physical facilities required. Included in the section on other computer applications are discussions of numeric and bibliographic databases. The concluding section presents a summary of CAI applications and describes facilities required in terms of terminals and microcomputers for specific library areas, and recommends furnishings and the proper environment. Listed are three references and a 17-item bibliography. (RBF)

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CAI AND COMPUTER FACILITIES FOR THE USE OF PATRONS IN A NEW CONCORDIA LIBRARY BUILDING: REPORT OF THE PROGRAMMED LEARNING COMMITTEE

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I. Introduction

The Programmed Learning Committee, consisting of E. Bruce, K. Hobbs, L. Singer and J. Tallon (chairman) was established at a meeting of Reader Services on March 25, 1981. The mandate assumed by the Committee was that of investigating and reporting on the needs of our user community for computer facilities within the Library building, exclusive of facilities relating to cataloguing or circulation systems. The activities examined include CAI and other instructional uses of computing, word processing, and direct access to bibliographic, source and numeric databases.

Minutes of the Committee's meetings are appended in Appendix I. In addition to surveying the literature available on user oriented computing facilities in academic libraries, the Committee undertook a number of activities to acquire additional information relating to CAI, computer facilities in libraries, and the Concordia context. These included:

1. A questionnaire of activities and plans in Concordia faculties and departments (Appendix II).

2. Soliciting information from the Concordia Computer Center and faculty active in CAI at Concordia.

3. Visits to the PLATO installation at the University of Quebec (Committee) and the terminal room at the University of Michigan Undergraduate Library (J. Tallon).

4. Discussion with personnel at the University of Guelph and Southwest Texas State University regarding terminals (Guelph) and microcomputer (Texas) installations in these libraries.

5. Solicitation of catalogs from agencies engaged in the production of CAI courseware for academic libraries.

The Committee felt strongly that, if accepted, this report will have immediate implications in addition to defining future building requirements. Although the provision of appropriate facilities in the new building is an important element in planning for future services, it is equally essential that adequate preparations be made. This should include: building Library expertise, developing a central depot of information, establishing regular contacts with other persons in the University community, and other libraries involved in these fields, and maintaining a current collection of catalogs and bulletins from suppliers of hardware, software and courseware. We also urge that the Library actively seek and encourage proposals that involve the provision of user oriented computer facilities on a limited basis in order to obtain first hand experience with the equipment and operations involved.

The following section discusses CAI applications for computer facilities within the Library. Other applications are treated in Section III, and space and environmental implications of the requirements as assessed in these two sections are given in Section IV.

My sincere appreciation goes to the members of the Committee, Concordia selection librarians for their assistance in completing the questionnaire, and to those persons outside the Library, especially Professor Boyd of Concordia's Education Department and Guy Bertrand of the University of Quebec, who gave generously of their time and knowledge in order to assist this effort.

II. CAI Applications

Taken in a broad sense CAI (Computer Assisted Instruction) covers a wide range of computer applications related to instruction. (1) These include:

1. Problem solving and data analysis. Problem solving activities often require the student to write programs or learn to manipulate programs such as SPSS (Statistical Package for the Social Sciences).

2. Learning Programming and Data Processing.

3. Simulation and modeling. Examples are business management games, ecological simulations, political and economic situations and nuclear experiment programs.

4. Drill. The same or similar questions on a topic are repeated until the student achieves mastery.

5. Tutorial. The computer presents the student with instructional materials, ask questions and branches ahead or to remedial material depending on the results.

   Within this category it is useful to distinguish between primary and adjunct CAI (2). Primary CAI involves the presentation via computer of entire credit courses or programs, for example Introductory Accounting and Remedial English. With the development of videotext this may become a commonplace form of distance learning.

   Adjunct CAI involves programs used in conjunction with classroom instruction to support or illustrate concepts, for example differentiation and integration in calculus.

6. Word processing.

Within this section we will use the term 'CAI' in a narrow sense to refer primarily to items 3 (simulation), 4 (drill) and 5 (tutorial), and other applications will be discussed in following sections.

Terms such as 'computer based learning', 'instructional computing' and 'CAL (Computer Assisted Learning') are used by various writers in preference to 'CAI'.

CAI Courseware

CAI courseware may be developed in house. Access to these materials may be either via terminal to the University's Computer Center or the program may be written on floppy disk and run on a microcomputer.

The local development of CAI courseware is time consuming, one hundred hours development time per hour of courseware being a generally accepted standard (2). In addition development requires either a person with knowledge of subject, programming and instructional design, or a team of experts in these fields working together.

An increasing number of materials are being made available for purchase, again either on tape for mounting on a mainframe or on floppy disk for use on a microcomputer.

At present a major source for University level programs is CONDUIT, an organization formed by a consortium of universities and located at the University of Iowa. These materials are carefully reviewed and tested, well documented and presented in a version of FORTRAN or BASIC that is essentially machine independent. In 1981 the CONDUIT library consisted of almost 100 programs, and approximately 2000 copies of programs were distributed. These programs related to biology, chemistry, economics, education, humanities, management, mathematics, physics, sociology, political science, geography, and psychology. Package prices,including manuals and guides, range from $5.00 to $150.00, with an average price of approximately $50.00.

Other sources for CAI materials for higher education include the Minnesota Educational Computing Consortium, California State University (Fresno), University of California (Irvine), and Stanford University.

Networks

One example of a CAI network is Health Education Network developed by the National Library of Medecine, and used by over 150 institutions.

Best known in this category is the SDC PLATO system. The PLATO project has been in existence for 20 years, and is centered at the University of Illinois. Terminals in a participating institution access a PLATO site via the telephone/telecommunications system. There are eight CDC PLATO sites, the nearest to Concordia being at the University of Quebec. The terminals themselves are designed specifically for delivery of PLATO materials, and feature display of graphics and animation, memory, selective erasure and optional slide selector, touch sensitive screen and audio cassette.

Unless the system is heavily used in an institution the cost of using PLATO is expensive. The terminal installed in Arts and Sciences (1979) cost $5,000 plus about $800 per month for system and communications.

Many hundreds of programs have been written for the PLATO system, relating to most disciplines taught in higher education. A selection of these courses listed in the 1978 Courseware Catalog included programs in Biology and Medical Sciences (7), Business (4), Chemistry (75), Computer Science (5), Languages (8), Advanced mathematics (8), Statistics (6), Music (7), Physics (44), and Social Sciences (6).

A recent innovation in the PLATO system is the development of stand alone microcomputer terminals and diskette versions of courseware. Programs in the academic library have not, however, been produced in this form, and there do not appear to be plans to produce these in the near future.

EDUNET is a computer resource sharing network for higher education in the U.S. and Canada. Canadian members include the universities of Calgary, Guelph, Manitoba, Ottawa and New Brunswick. Annual membership would be $1,325 (U.S.) for Concordia.

Fourteen universities in the EDUNET system act as suppliers of computing resources. These include the universities of Delaware, Cornell, MIT, Michigan, Yale and Southern California.

Users access programs from a supplier's computer using a terminal or microcomputers and TYMSHARE or Telenet systems. The microcomputer, disk drive and software can be purchased through EDUNET for about $2300, and allows automatic logon to suppliers' computers and uploading and downloading of files between the micro and supplier. Some examples of EDUNET use for CAI materials are: bibliographic search and retrieval techniques, training on DIALOG and ORBIT, legal courseware, small business training, diagnosing adult literacy problems, and urban simulation (EDUNET INFORMATION BULLETIN, August 1980).

CAI at Concordia

Since the early 1970's a small number of programs have been developed and used in Concordia in the areas of computer language, physics, civil engineering, remedial English and remedial mathematics. In 1978 an extensive effort was made by the Computer Center to make Concordia administration and faculty aware of the possibilities of PLATO. A terminal was purchased in 1979 by the Faculty of Arts and Sciences and used mainly for courses in the Physics Department. Because of the expense involved this project was discontinued in 1980.

As part of ongoing research in the Educational Technology department students create CAI programs on microcomputers in the Department. In 1981-82 use of CAI programs is planned in the areas of remedial mathematics (mature students) and chemistry.

Responses to the Committee's questionnaire indicated current use of computers for instructional purposes in Biology, Accounting (planned), Finance, Exercise Science, CBS, Mechanical Engineering, Sociology, Library Studies (in development), TESL and Education.

Planning for the Future

Johnson's summary of the 1979 CONDUIT survey (3) indicates that the main reasons for low level of CAI use are lack of courseware and hardware. Computing hardware is rapidly becoming less expensive, however the cost of providing an adequate number of microcomputers or terminals and central processing for a large scale CAI effort remains large. Courseware is very costly and time consuming to produce. However as microcomputers are being purchased by the Universities and Colleges in ever increasing numbers a potential market is being created that may eventually justify this cost in the manner that text book production is justified today.

Chambers and Sprecher (2), after summarizing past and current predictions of about a dozen writers in this field, conclude that while early expectations have not been met, technological advances will result in rapid increases in CAI use. Mossman (1) and Johnson (3) agree that CAI use will increase, but are more reluctant to predict the rate of increase. It is evident that there are numerous factors: technology, increasing familiarity of students with computers, videotext, university budgets, etc. that could dramatically change this situation.

Given the uncertainty that exists with respect to the general trend of CAI in higher education it would seem somewhat fanciful to try to determine where Concordia will fit into this trend. In the absence of any more substantial information we might take the growth rate of 16% per year as indicated in the comparison of 1979 and 1977CONDUIT surveys (3) as a basis for prediction. However, there is obvious potential for this growth rate to be either not met or greatly exceeded and where flexibility is possible in our planning in this area it would seem to be strongly preferred.

In addition to requiring flexibility in planning for long range growth of CAI activity we should plan for flexibility with respect to yearly variations in CAI activity. As is evidenced by the past history of CAI activity there will be large changes from year to year depending on faculty interest, courses taught and what is available in appropriate courseware. Assuming that the Library is open 86 hours per week and student stations are used on the average at 60% capacity we would require .5 student stations for each 25 students using CAI one hour per week. The decision by one large course to use or discontinue use of CAI could thus substantially affect facility requirements. For example we would require 8 student stations to accomodate a class of 200 students using CAI 2 hours per week.

Role of the Library

To a large extent CAI materials can be discovered, selected, and organized and accessed in a manner similar to materials in the Library's print and nonprint collections, and are used by the same people and for the same purposes as those materials. Because of this the basic mechanisms exist for the Library to assume responsibility for CAI collections and service.

At present at Concordia this responsibility rests mainly with individual faculty and departments. Compared to this situation Library involvement could bring a number of advantages:

1. Avoidance of duplication of effort and resources by individual faculty; coordination of activity.

2. Individual efforts could be greatly facilitated by having, for example, ready access to information and procedures, and use of already established physical facilities.

3. Use of materials and equipment could be maximized because of the Library's central site, hours, and access tools.

4. Related print sources, Library service and study facilities would be the same location as facilities for CAI use.

5. Library activity in spreading information concerning materials available and the visibility of use in the Library would encourage further use.

As a result of these consideration we recommend that the Library pursue an active role with regard to CAI. This would eventually include gathering and dissemination of information on resources available, acquisition of materials in consultation with faculty and the Computer Center, provision of access facilities, and the provision of appropriate bibliographic access and reference service. The provision of CAI materials and access in the Library would complement facilities (microcomputers and terminals) presently existing or planned in the Departments and other University locations.

Physical Facilities Required

Based on what has been written to this point facilities of two types will be required: microcomputers and terminals to the Computer Center. Should Concordia access an outside network telephone connections would be required for those stations.

It is recommended that microcomputer stations be located in Nonprint, where there would also be housed a disc library. The Reference Area and Nonprint would be most appropriate for Computer Center terminals for CAI applications because of service potential. Terminals in these areas could be dedicated through the Computer Center, to CAI programs only. Should less terminals be needed these could be released for general use; if more were needed terminals in other areas could be assigned to CAI use.

Terminals in the Reference Area could also be used for Library Orientation should suitable materials become available. In addition, at least two carrels in Reference should be wired so that microcomputers could be installed for orientation purposes.

III. Other computer applications

a. Numeric Databases

A numeric database (numeric databank) is a collection of variables and their values in machine readable form. Examples include population (census) data, opinion surveys, market surveys, financial data on corporations and securities, international exchange statistics, physical properties, etc. The majority of numeric databases are found in the social sciences, with most of the remainder being found in the physical sciences.

A numeric database system includes one or more numeric databases and programs required for accessing the data and performing frequently required manipulations. Database systems may be accessed online from commercial or public agencies. The Fall 1979 CUADRA Directory of Online Databases lists over 400 databases available online throughout North America. Of these, 60% were nonbibliographic, and over 75% of those are numeric (Wagner, J. "Nonbibliographic Online Data Base Services" J.S.A.S. May 1980). The remaining 25% were source (primarily textual) databases.

Other numeric databases are either not available online or are available online but would be more economical to use if purchased. Purchase involves the acquisition of the database from a data archive such as the Inter-university Consortium for Political and Social Research or the Machine Readable Archives division of the Public Archives of Canada. In November 1980 the Library undertook a pilot project in this area with the acquisition of the CANSIM Minibase tapes.

The Library has received a number of requests for access to numeric databases from various departments, and a survey of academic departments in July 1980 showed 4 out of 12 respondents using numeric databases and interested in the Library playing a coordinating role. It seems reasonable to assume that the Library will become extensively involved in this area in the next few years.

At the present time a librarian acts as an intermediary between the end user and the database system for bibliographic searches performed in the Library. To some extent this will be true of numeric database searching, however many systems of this type, because of the technical and statistical knowledge required and the role they play in the research process, would be more appropriate for direct

searching by the end user. In such cases the Library would have the role of determining that the information required by the user is available from a particular source, providing access or referring the user to an agency that could provide access, and maintaining the documentation needed by the user in the search process.

To accomodate these developments in the new library building we should plan for terminals to access both the Computer Center and outside services. A single terminal with a switching mechanism might be used to serve both purposes; this mechanism could be eliminated if the Computer Center develops at some point the facility in the central computer to connect users to the communications network. Some terminals appropriate for this application should be located in Reference and Government Documents to permit easy access to reference service by the user operating the system and to facilitate the referral process. For patrons making frequent use of the same numeric databases, notably sutdents using data in the central computer as part of their coursework[1], terminals could be in an area more remote from these service points.

b. Bibliographic Databases

Bibliographic databases include databases of the type presently offered by online services such as DIALOG and CAN/OLE, and library catalogs or collective catalogs such as BADADUQ and REFCATSS.

The Library's role in the provision of direct patron access to bibliographic databases must at this time be speculative, however the Committee felt that there were numerous indications that some activity in this area would in future be warranted. We understand that courses to teach bibliographic searching to students in various programs are being contemplated by the University; given furthermore the commercial nature of many online services and potential search capabilities of consumer oriented videotext systems, it seems reasonable to expect that a growing number of end users will become involved in bibliographic searching. The rapid development and application of online catalog technology, networking and communications[2] indicates that in addition the Library will in future be able to offer our users online access not only to Concordia holdings but also those of other libraries on a regional, national or even international basis.

1. Of the 17 faculty responding to a survey conducted on potential use of the CANSIM Minibase, 11 indicated their intention to use it for teaching purposes.

2. Bell Canada is planning field trials for a simplified access system that allows a user to select from a menu displayed at his terminal any of a number of library catalogs and online services.

Another related area in which the Library could become involved is in the provision of facilities for access to information sources available on commercial or public videotext systems. In fact it is conceivable that this type of information resource could rival or surpass in importance print and nonprint resources within the expected life of the new library building.

It seems unlikely that any of these developments will be sufficiently advanced in three years to imply specific space requirements in the new library building. However, they should be closely monitored. In general a need for flexibility with respect to communications lines and equipment is strongly implied, foremost in the reference area but in all other areas as well.

c. Problem Solving, Data Analysis and Retireval, Computer Science, Word Processing

A small percentage of these applications demand use of library materials. For example: a student using a text editing program may take quotes, references or other information directly from books and journals, a chemist using a spectral analysis program may need recourse to a handbook for properties of candidate compounds, a social scientist may wish to enter data from a statistical yearbook or survey for analysis using a statistical program.

To accomodate this type of requirement in the new library building we recommend that terminals (or possibly microcomputers with interface) connected to the central computer be located in the reference, government documents and home environment areas.

In addition we recommend the provision of such terminals, primarily in the home environment areas for these applications in general. For the library user such facilities would offer the convenience of being able to switch easily from study and research involving library materials to that involving computer use, and vice-versa. In addition to this benefit we believe the library would offer a number of advantages as a terminal location, including long hours, centrality and high visibility.

IV. Space Implications and Environment

a. Summary of applications

Application	Requirement	Locations
CAI	microcomputers	Nonprint
	disk library	Nonprint
	printers	Nonprint
	terminals (or microcomputers with interface)	Nonprint, Reference, Home Environments
CAI (Orientation)	microcomputers/ terminals	Reference
Numeric databases	terminals	Reference, Government Publications, Home Environments
	terminals (outside access)	Reference, Government Documents
Bibliographic databases	---	--
General applications (Library materials)	terminals	Reference, Government Publications
General applications (unrestricted)	terminals	Home Environments

b. Facilities Required

1. Terminals hardwired to the Computer Center or microcomputers with interface to the central computer.

   The considerations raised in the preceeding section give some indication of the number of terminals/ microcomputers required for each application. Based on these considerations we estimate that eighteen (18) terminals/microcomputers will be required at opening day for CAI applications, eight (8) for general applications relating to use of library materials, four (4) for data base searching, two (2) for library orientation and twenty (20) for general applications (a total of fifty-two (52) terminals/microcomputers).

   Estimates for particular applications are significant only within the context of formulating Library requirements and planning the most advantageous location of facilities. In terms of actual use of the facilities there will be a high degree of flexibility, ranging from completely unrestricted use of all terminals to all terminals being restricted to specific programs (e.g. CAI, numeric databases) and requiring reservations for use. Initially all terminals may be un-

restricted. Later if the demand for certain applications in a particular area (e.g. CAI programs in Nonprint) could not be accomodated, use of terminals in that area could restricted by means of signs, reservations, or restriction by the central computer of terminals to specific programs. Plans for a reservation system for terminals should be considered in the context of overall planning for reservations in the new building.

We are firmly of the opinion that there will be a growing demand for user oriented computer facilities. The Library Building should be sufficiently flexible to permit accomodation of these requirements to whatever extent is necessary. Specifically, we recommend that each of the terminal/microcomputer locations be situated so that it can be easily expanded to accomodate twice the facilities planned for opening day (the capacity for a total of 104 terminals/microcomputers).

We recommend that the terminals/microcomputers be distributed so as to relate most effectively to relevant library services, and that they be pooled within each area in order to minimize disturbance to other users and to simplify location of the terminals by the user. This would result in the creation of five pools of approximately ten terminals/microcomputers each.

We recommend that these terminal/microcomputer pools be distributed as follows (opening day):

1. Reference Area. Sixteen (16) terminals/microcomputers. We recommend that there be a pool of twelve (12) terminals/microcomputers in the Reference Area for general applications requiring reference materials or service, and CAI applications requiring specialized assistance. There should also be space in this area for two microcomputers with interface to the Computer Center for possible Library Orientation applications, and two terminals/microcomputers with telephone access to outside systems in addition to Computer Center access for database searching.

2. Government Documents. Six (6) terminals/microcomputers. Four terminal/microcomputers are recommended in this area for general applications involving Government Documents materials and services and two terminals/microcomputers with access to outside systems and the Computer Center for numeric database searching.

3. Nonprint. Ten (10) terminals/microcomputers. For CAI applications requiring only general assistance.

4. Home Environments. Two pools of ten (10) microcomputers/terminals, one to be located on each of the main home environment floors, for general applications.

It is recommended, because of noise and service considerations, that terminals/microcomputers connected directly to the Computer Center have CRT display only. The central computer has the facility to accept print requests from the users terminal and produce print outs on a high speed printer for later pick up by the user. It is recommended that the possibility of installing a high speed printer in the new building, possibly as part of a centralized printing services depot, be discussed with the Computer Center.

The Committee did not feel it necessary to specify at this stage the type of equipment to be used in accessing the central computer, thus the term 'terminal/microcomputer' has been used in preference to 'terminal'. In virtue of their greater flexibility we recommend that consideration be given to the selection of microcomputers for this purpose. We recognize, however, that the Computer Center does not provide microcomputers for general access at this time, and that at this date such equipment is quite unreliable and thus would present maintenance problems.

We recommend that the Library commence discussions with the Computer Center to determine the responsibilities of each with respect to facilities and service in the context of the new building. It is our opinion that it would be most appropriate for the Library, with respect to terminals/microcomputers connected to the central computer, to restrict its involvement to:

1. The provision of space and furnishings

2. The provision of assistance relating to programs that are the property of the Library, or other programs when the Library has made prior arrangements with particular faculty or departments that such assistance will be provided.

3. The provision of printed user aids appropriate to the above, and, in cooperation with the Computer Center, the provision of other user aids, guides, manuals, bulletins, etc. that may be required by users of the central computer.

This implies that responsibility for equipment, service, and general assistance with programs and programming would be assumed by the Computer Center. In order to accomodate these requirements we recommend the installation of internal phones in each terminal pool location for users to report equipment problems and request assistance directly from the Computer Center. In order to accomodate the need for printed materials we recommend that each location be equipped with shelving and display facilities.

2. Stand alone microcomputers

It is recommended that the Library plan on opening day for a pool of ten (10) stand alone microcomputers with disk drives and CRT display, and two associated printers. These would be housed in the Nonprint Area, which could undertake responsibility for maintenance, control and general assistance of the type now offered for nonprint materials and equipment. These microcomputers would be used for CAI applications, and a library of CAI courseware, either purchased or produced in-house, would be housed in the area.

As with facilities for access to the central computer we anticipate a growing demand in this area, and recommend that this facility be planned so that it can be easily expanded to two times the opening day capacity (total 20 microcomputer stations).

3. Summary of facilities required

Area	Equipment	Opening Day Requirements	Expansion Requirements
Reference Area	terminals/microcomputers	12	12
	microcomputers with interface	2	2
	terminals/microcomputers for searching outside databases	2	2
	TOTAL student stations	16	16
	external telephones	2	2
	shelving	1	--
	display	1	--
	internal telephones	1	--
Government Documents	terminals/microcomputers	4	4
	terminals/microcomputers for searching outside databases	2	2
	TOTAL student stations	6	6
	external telephones	2	2
	shelving	1	--
	display	1	--
	internal telephones	1	--

Area	Equipment	Opening Day Requirements	Exapnsion Requirements
Nonprint	terminals/microcomputers	10	10
	stand alone microcomputers	10	10
	TOTAL student stations	20	20
	internal telephones	1	--
	shelving	1	--
	display	1	--
	cabinet for disk library	1	--
	printers	2	1
Home Environments			
Floor A	terminals/microcomputers	10	10
	TOTAL student stations	10	10
	internal telephones	1	--
	shelving	1	--
	display	1	--
Floor B	terminals/microcomputers	10	10
	TOTAL student stations	10	10
	internal telephones	1	--
	shelving	1	--
	display	1	--
Total student stations (all locations)		62	62

c. Furnishings and environment

It is recommended that terminal stands without adequate space for equipment and printed materials be avoided in the interest of flexibility of use of equipment. Equipment should be housed at tables or carrels (preferably carrels). These should be large enough to house comfortably a terminal or microcomputer/disk drive unit and printed materials, thus they should be larger than the standard sized student station. Chairs, and tables or carrels, should be at a height appropriate for typing.

Terminal/microcomputer pools should be semi-isolated from quiet study areas by walls, partitions, stacks, furnishings or location. Printers should be well isolated for sound.

Carpeting must be anti-static. Lighting -type and intensity- should be compatible with the CRT's selected, and direct natural light should be avoided.

Special furnishings for the handicapped should be considered by the Committee on Barriers to the Handicapped.

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